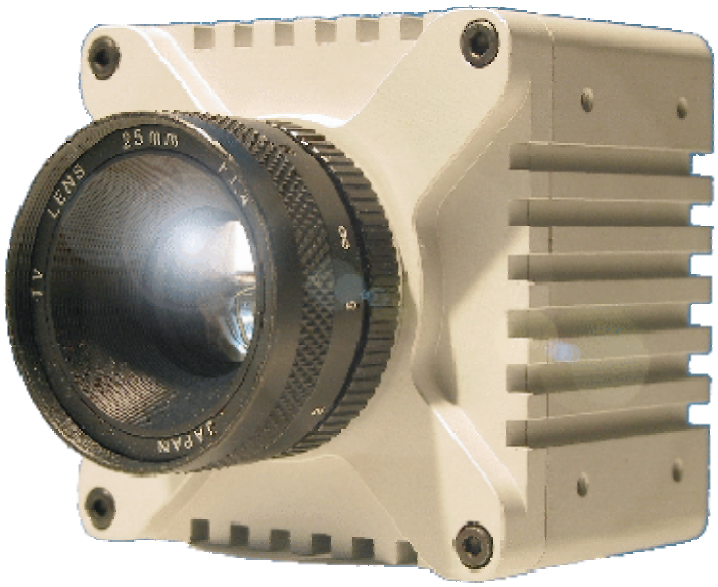
Help Manual Rev. 1.6

C3-Explorer

Automation Technology GmbH



Contents

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Overview

Introduction

The C3 Explorer is a software package for the configuration of C3-Cameras via Camera Link or GigE. It features a user-friendly GUI, which demonstrates the implementation of the C3Lib function library and supports live image acquisition for a variety of Camera Link frame grabbers. Furthermore, the C3 Explorer allows modification of complete register set of cameras supports storing of start-up configuration in camera and allows storing of captured 3D data as TIFF or PNG bitmap as well as in binary format.

The information in this manual can also be found in the online help of the program.

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Installation

System Requirements

The system requirements of C3 Explorer are listed in the following table:

Operating System	Windows XP, Windows™ 2000, Windows™ NT4 (depending on available frame grabber drivers)
Hardware	x86 based 32-Bit microprocessor, e. g. Intel Pentium IV.
	Camera Link frame grabber
	C3-Camera

Installing the Software

1. The computer is started and you are logged in. For Windows NT, Windows 2000 and Windows XP, you need to be logged in with administrative rights.
2. Insert the C3-Support Package CD-ROM.
3. The CD-ROM Installation Program starts. If it does not start automatically, double click the CD-ROM icon to enter the Installation Program.
4. Follow the installation procedure. Be aware that the computer may need to be restarted once after installation.
5. After the installation is completed, check the installation using the "C3-Explorer" program.

The Laser Triangulation Measuring Principle

Overview

The C3 camera acquires height profiles and height images based on the laser triangulation principle. According to this method a laser line is projected on the object from one direction. The C3 camera views the object from another angle defining the triangulation geometry. The resulting sensor image is evaluated by the C3 camera core and converted into a single height profile. By scanning the laser line over the object a complete height image can be acquired.

The figures below demonstrate some typical triangulation geometries. The following notation is used in the approximation of height resolution:

ΔX= resolution along the laser line (lateral),

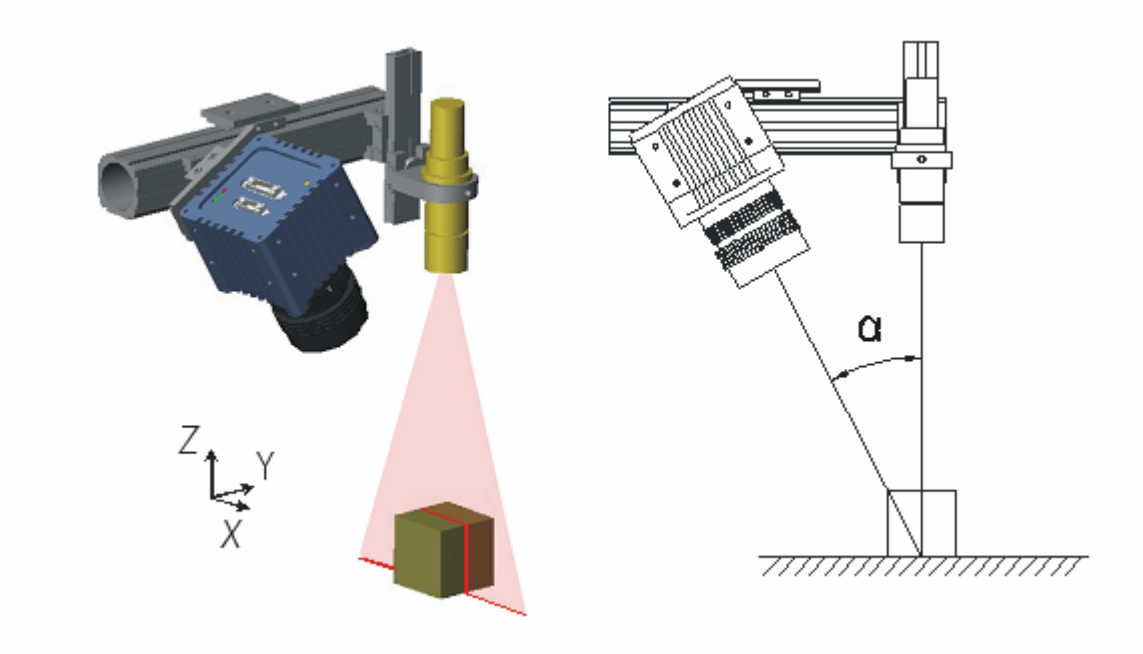
ΔY= resolution perpendicular to the laser line (longitudinal in the direction of motion),

ΔZ= height resolution.

Geometry 1

The laser line is projected perpendicular to the object surface, while the camera views the object under the triangulation angle α.

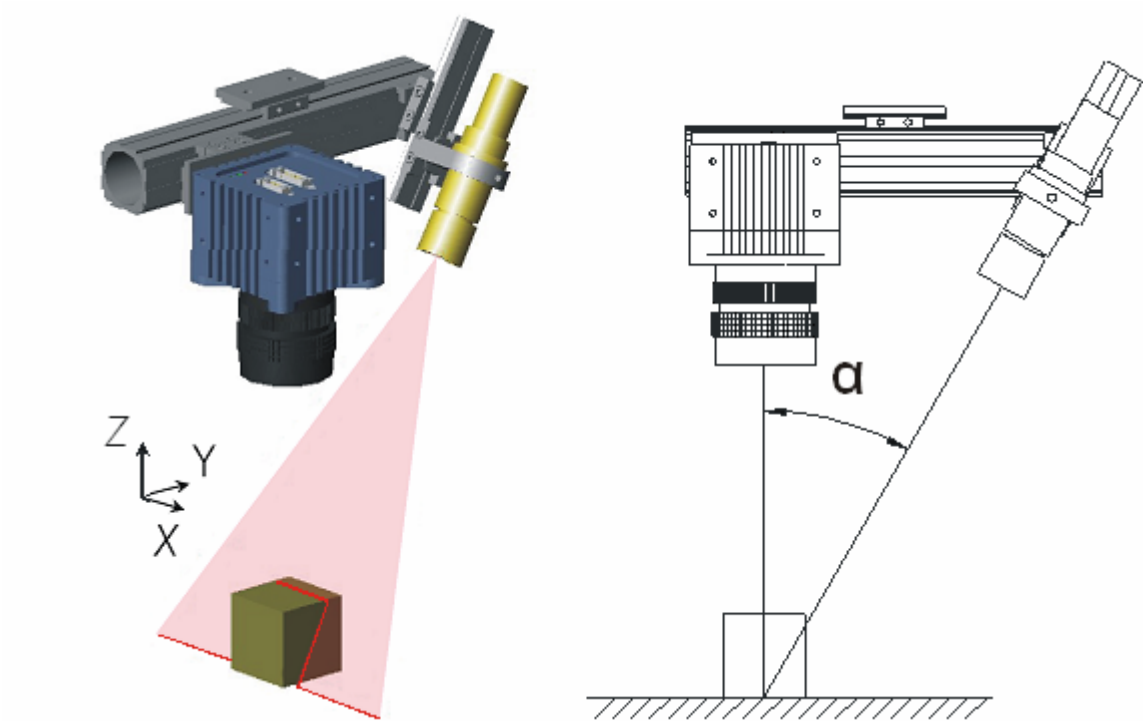
The height resolution can be approximated: $\Delta Z \approx \Delta X / \sin(\alpha)$



Geometry 2

The camera views the object perpendicularly to its surface, while the laser line is projected under the triangulation angle α.

The height resolution can be approximated: $\Delta Z \approx \Delta X / \tan(\alpha)$

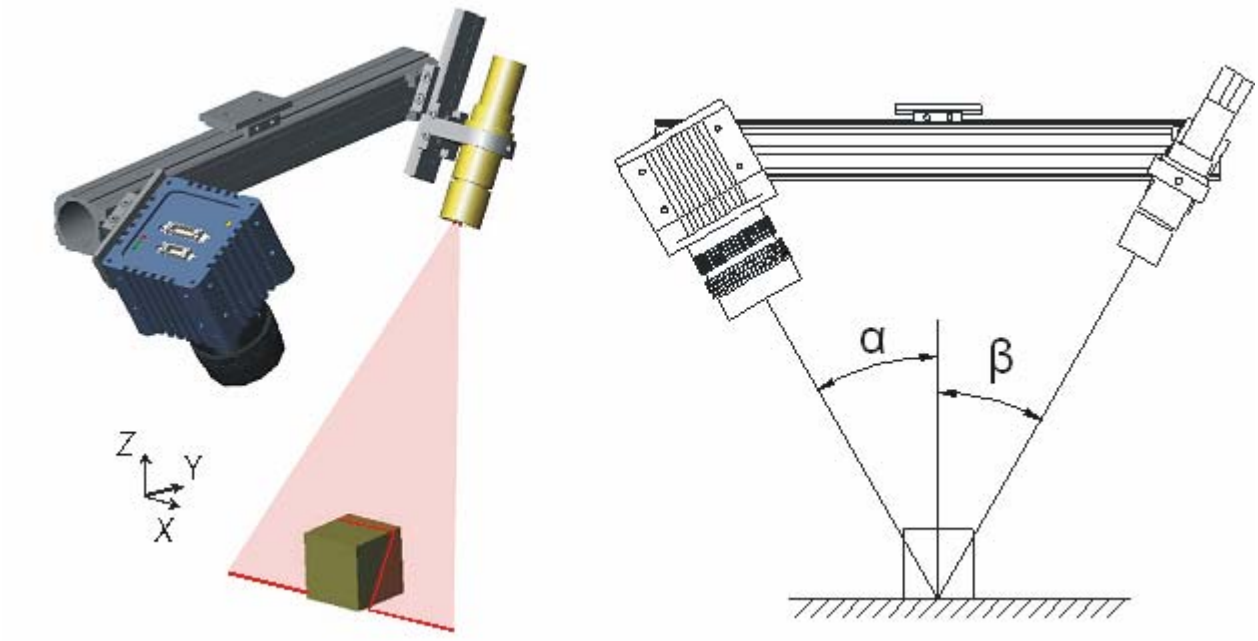


Geometry 3

The camera views the object under an angle α, while the laser line is projected under a different angle β.

The height resolution can be approximated: $\Delta Z \approx \Delta X * \cos(\beta) / \sin(\alpha + \beta)$,

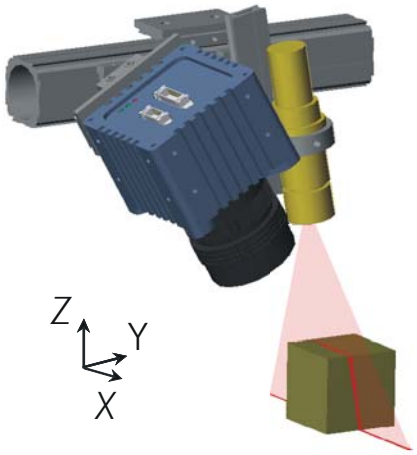
in case $\alpha = \beta$ (direct reflex) : $\Delta Z \approx \Delta X / 2 * \sin(\alpha)$

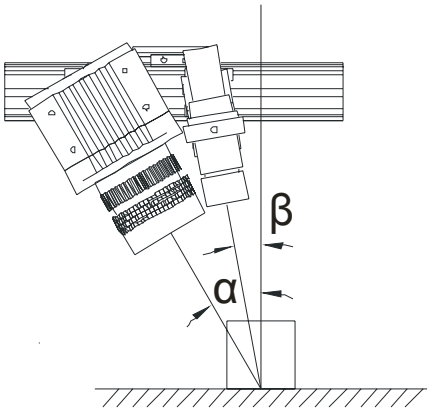


Geometry 4

The camera views the object under an angle α, while the laser line is projected under a different angle β at the camera side.

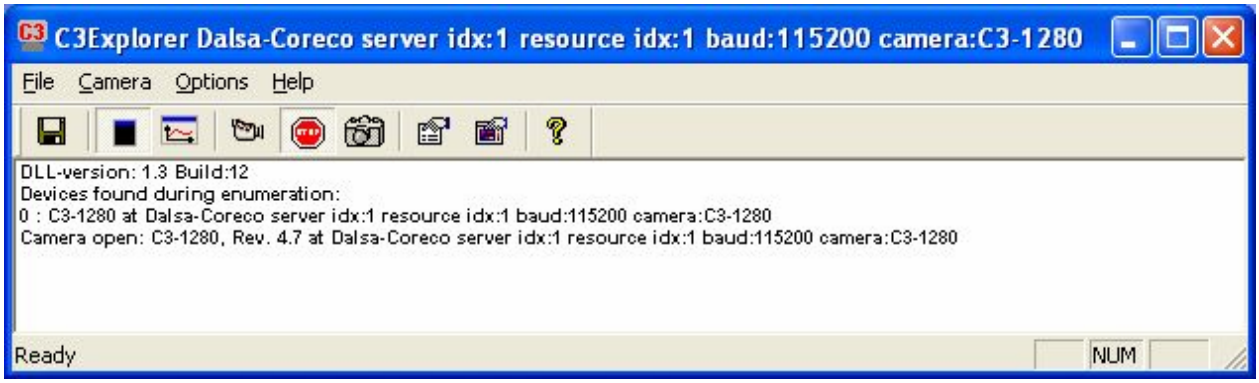
The height resolution can be approximated: $\Delta Z \approx \Delta X * \cos(\beta) / \sin(\alpha - \beta)$,





The C3 Explorer GUI

The C3 Explorer toolbar



- Export current image data in TIFF, PNG or binary format
- Show image display
- Show 2D-View profile graph
- Start live image capture
- Stop live image capture
- Snapshot
- Camera settings
- Options
- Help

The C3 Explorer menu bar

File

Export image data	Export current image data in TIFF, PNG or binary format
Save camera configuration	Save camera configuration parameters to C3C file
Load camera configuration	Load camera configuration parameters from C3C file
Printer Setup	Setup printer
Exit	Exit C3-Explorer

Camera

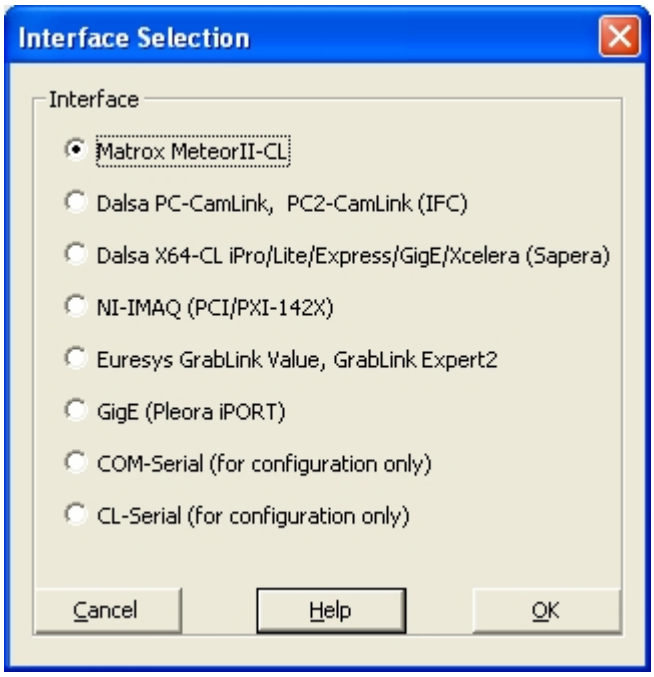
Open camera connection	Show the interface selection dialogue box and open connection to the C3 camera.
Close camera connection	Close the current connection to the C3 camera
Display Mode	Set the current display mode:
	Show image displays: activate the image display
	Show 2D profiles: activate the 2D-View profile graph
Camera Settings	Open camera settings dialogue box
Start Live	Start live image acquisition
Stop Live	Stop live image acquisition
Snapshot	Take a snapshot
Save camera start-up values	Save start-up configuration parameters of the camera
Set camera factory settings	Restore the default configuration parameters of the camera
Camera Control	
Reset Camera	Perform a global camera reset
Reset Sequencer and Sensor	Reset the camera internal sequencer
Start Sequencer	Start the camera sequencer
Stop Sequencer	Stop the camera sequencer
Generate Software Trigger	Generate a software trigger
Load Resolver Counter	Load the resolver trigger counter

Options Show the general settings dialogue box.

Help

Help context	Shows the online help.
About C3-Explorer	Shows release information of C3-Explorer and C3-Lib DLLs.

The Interface selection dialogue box



The interface selection dialogue box appears by selecting the menu item Open camera connection from the menu Camera.

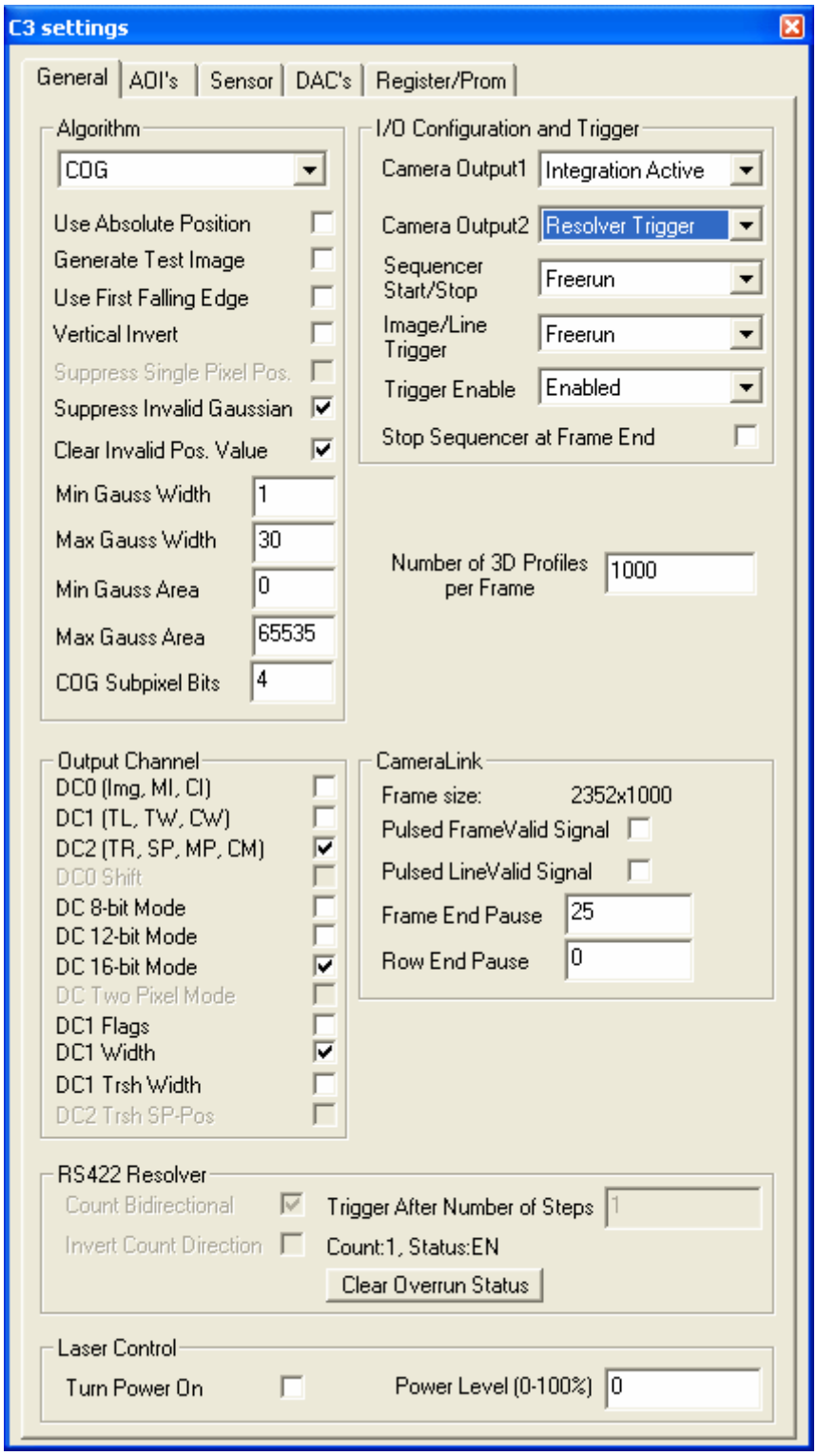
Matrox MeteorII-CL	Open connection to C3 camera using frame grabber driver for Matrox MeteorII-CL (MIL). The c3lib_mil.dll is loaded.
Dalsa PC-CamLink, PC2-CamLink	Open connection to C3 camera using frame grabber driver for Dalsa PC-Camlink, PC2-Camlink (IFC). The c3lib_ifc.dll is loaded.
Dalsa X64-CL iPro/Lite/Express/GigE /Xcelera	Open connection to C3 camera using Sapera frame grabber software and drivers for Dalsa X64-CL iPro/Lite/Express/GigE and X64-Xcelera-CL. The c3lib_sapera.dll is loaded.
NI-IMAQ PCI/PXI-142X	Open connection to C3 camera using frame grabber driver for National Instruments NI-IMAQ (PCI/PXI-1426, -1428). The c3lib_imaq.dll is loaded.
Euresys GrabLink Value, GrabLink Expert2	Open connection to C3 camera using frame grabber driver for Euresys GrabLink Value, GrabLink Expert2 (Multicam). The c3lib_emc.dll is loaded.
GigE (Pleora iPORT)	Open connection to C3 camera using Pleora iPORT Gigabit Ethernet driver. The c3lib_pleora.dll is loaded.
COM-Serial	Open connection to C3 camera using a standard COM-port (e.g.

	COM4) interface. In this case the C3Explorer is used as a configuration tool only. No image acquisition functions can be used. The c3lib_uart.dll is loaded.
CL-Serial	Open connection to C3 camera using the clserial driver of the CameraLink interface. In this case the C3Explorer is used as a configuration tool only. No image acquisition functions can be used. The c3lib_clser.dll is loaded.

The camera settings dialogue

The Camera settings dialogue box appears by selecting the menu item Camera settings from the menu Camera or by clicking the  icon on the C3 Explorer toolbar. Please refer to the C3 hardware reference manual for a detailed description of the C3 camera settings.

General Tab


C3 settings
General
AOI's
Sensor
DAC's
Register/Prom
Algorithm
COG
Use Absolute Position
Generate Test Image
Use First Falling Edge
Vertical Invert
Suppress Single Pixel Pos.
Suppress Invalid Gaussian
Clear Invalid Pos. Value
Min Gauss Width
1
Max Gauss Width
30
Min Gauss Area
0
Max Gauss Area
65535
COG Subpixel Bits
4
I/O Configuration and Trigger
Camera Output1
Integration Active
Camera Output2
Resolver Trigger
Sequencer Start/Stop
Freerun
Image/Line Trigger
Freerun
Trigger Enable
Enabled
Stop Sequencer at Frame End
Number of 3D Profiles per Frame
1000
Output Channel
DC0 (Img, MI, CI)
DC1 (TL, TW, CW)
DC2 (TR, SP, MP, CM)
DC0 Shift
DC 8-bit Mode
DC 12-bit Mode
DC 16-bit Mode
DC Two Pixel Mode
DC1 Flags
DC1 Width
DC1 Trsh Width
DC2 Trsh SP-Pos
CameraLink
Frame size:
2352x1000
Pulsed FrameValid Signal
Pulsed LineValid Signal
Frame End Pause
25
Row End Pause
0
RS422 Resolver
Count Bidirectional
Invert Count Direction
Trigger After Number of Steps
1
Count:1, Status:EN
Clear Overrun Status
Laser Control
Turn Power On
Power Level (0-100%)
0

Algorithm

Parameter	Description	Register Operation
Algorithm: Image	Set the image mode	Set bit CFG_ALG_IMG in register CFG_REG.
Algorithm: Threshold Position	Set the 3D mode using the threshold algorithm.	Set bit CFG_ALG_TRSH in register CFG_REG
Algorithm: Max. Pos.+Intensity	Set the 3D mode using the maximum intensity algorithm.	Set bit CFG_ALG_MAX in register CFG_REG
Algorithm: COG	Set the 3D mode using the centre of gravity (COG) algorithm.	Set bit CFG_ALG_COG in register CFG_REG
Use Absolute Position	Calculate height position as absolute values	Set bit CFG_ALG_ABS_POS in register CFG_REG
Generate Test Image	Generate artificial image of laser line	Set bit CFG_ALG_TEST_IMAGE register CFG_REG
Use First Falling Edge	Use first falling edge of the intensity profile in 3D mode with threshold and COG algorithm.	Set bit CFG_ALG_TRSH_FIRST_FALLING in register CFG_REG
Vertical Invert	Flip the image vertically	Set bit CFG_ALG_VERTICAL_INVERT register CFG_REG
Suppress Single Pixel Pos.	Suppress positions with single pixel width.	Set bit CFG_ALG_SUPPRESS_SINGLE_PIXEL_LINE in register CFG_REG
Suppress Invalid Gaussian	Suppress any detected Gaussian curve, which does not fulfil the validation criteria	Set bit CFG_ALG_POS_VALIDATION_EN in register CFG_REG
Clear Invalid Pos. Value	Suppress any invalid 3D position value in all DCs	Set bit CFG_ALG_CLEAR_INVALID_POS in register CFG_REG
Min Gauss Width	Minimum width tolerance of Gaussian intensity distribution	Set value in register WIDTH_VALID_MIN_REG
Max Gauss Width	Maximum width tolerance of Gaussian intensity distribution	Set value in register WIDTH_VALID_MAX_REG
Min Gauss Area	Minimum area tolerance of Gaussian intensity distribution	Set value in register SUM_INT_VALID_MIN_REG
Max Gauss Area	Maximum area tolerance of Gaussian intensity distribution	Set value in register SUM_INT_VALID_MAX_REG
COG Subpixel Bits	Number of subpixel bits to be included in the result of COG height calculation	Set bits DATAOUT_NUM_SP in register DATAOUT_REG

Output Channel

Parameter	Description	Register Operation
DC0 (Img, MI, CI)	Activate the output data channel DC0.	Set bit DATA_OUT_DC0 in register DATAOUT_REG
DC1 (TL, TW, CW)	Activate the output data channel DC1	Set bit DATA_OUT_DC1 in register DATAOUT_REG
DC2 (TR, SP, MP, CP)	Activate the output data channel DC2	Set bit DATA_OUT_DC2 in register DATAOUT_REG
DC0 Shift	Right shift twice the intensity value in DC0, i.e. convert to 8 bit (recommended for use only with intensity values when DATAOUT_8BIT=1)	Set bit DATAOUT_DC0_SHIFT in register DATAOUT_REG
DC 8Bit Mode	Enables 8-bit mode in all output data channels	Set bit DATAOUT_8BIT in register DATAOUT_REG
DC 12Bit Mode	Enables 12-bit mode in all output data channels	Set bit DATAOUT_12BIT in register DATAOUT_REG
DC 16Bit Mode	Enables 16-bit mode in all output data channels	Set bit DATAOUT_16BIT in register DATAOUT_REG
DC Two Pixel Mode	Output two pixel values in one cycle	Set bit DATAOUT_TWO_PIXEL_OUT in register DATAOUT_REG
DC1 Flags	When in 16-bit mode, the bits 3-15 of output channel DC0 contains additionally the algorithm flags	Set bit DATAOUT_DC1_FLAGS in register DATAOUT_REG
DC1 Width	Output the laser line width in channel DC1, when COG algorithm is selected	Set bit DATAOUT_DC1_WIDTH in register DATAOUT_REG
DC1 Trsh Width	Output the laser line width in channel DC1, when threshold algorithm is selected	Set bit DATAOUT_DC1_TRSH_WIDTH in register DATAOUT_REG
DC2 Trsh SP-Pos	Output the sum of left and right threshold position (sub pixel in channel DC2, when threshold algorithm is selected	Set bit DATAOUT_DC2_TRSH_SP in register DATAOUT_REG

I/O and Trigger Configuration

Parameter	Description	Register Operation
Camera Output1: Integration Active	The camera output 1 is set to "high" during the integration period	Set bit IO_OUT1_INTEG_ACTIVE in register IO_REG
Camera Output1: Sequencer Active	The camera output 1 is set to "high" as long as the sequencer is active	Set bit IO_OUT1_SEQ_ACTIVE in register IO_REG
Camera Output1: Readout Active	The camera output 1 is set to "high" during the readout period	Set bit IO_OUT1_READOUT_ACTIVE register IO_REG
Camera Output1: Internal Trigger	The camera output 1 is set to "high" during the readout period	Set bit IO_OUT1_READOUT_ACTIVE register IO_REG
Camera Output2: Frame Valid	The camera output 2 is set to "high" during the period of frame transfer (Frame Valid)	Set bit IO_OUT2_FRAME_VALID in register IO_REG
Camera Output2: Line Valid	The camera output 2 is set to "high" during the period of row transfer (Line Valid)	Set bit IO_OUT2_LINE_VALID in register IO_REG
Camera Output2: Resolver Count Dir	The camera output 2 is set to "high" when the camera is triggered by resolver signal.	Set bit IO_OUT2_CNT_DIR in register IO_REG
Camera Output2: Resolver Trigger	Output the resolver signal each time a trigger occurs.	Set bit IO_OUT2_CNT_ZERO in register IO_REG
Camera Output2: OVR Flag	Output is high when Trigger Overrun occurs (OVR flag).	Set bit IO_OUT2_OVR in register IO_REG
Sequencer Start/Stop: Free run	Image acquisition is performed in free run mode	Set bit CFG_SEQ_FREERUN in register CFG_REG
Sequencer Start/Stop: Camera Input 1, 2	Use trigger signal to start / stop the sequence over the external inputs IN1, IN2	Set bit CFG_START_STOP_MODE in register CFG_REG and bit IO_START_STOP_SEQ_IO_EN in register IO_REG
Sequencer Start/Stop: CameraLink CC(2), CC(3)	Use trigger signal to start / stop the sequence over the Camera Link control signals CC(2) and CC(3)	Set bit CFG_START_STOP_MODE in register CFG_REG and bit IO_START_STOP_SEQ_CC_EN in register IO_REG
Image/Line Trigger: Freerun	Image integration is performed in free run mode	Set bit CFG_INTEG_FREERUN in register CFG_REG
Image/Line Trigger: Resolver RS422	Trigger image using external RS422 resolver signals	Set bit TRIG_CNT_CNT_MODE and TRIG_CNT_LOAD_AT_START in register TRIG_CNT_H_REG
Image/Line Trigger: Camera Input1	Trigger image using external input IN1	Set bit IO_TRIGGER_IO_EN in register IO_REG
Image/Line Trigger: CameraLink CC(1)	Trigger image using Camera Link control signal CC(1)	Set bit IO_TRIGGER_CC_EN in register IO_REG
Trigger Enable: Enabled	Enables the camera triggering, when EXT_TRIG_INTEG_MODE=0	
Trigger Enable: Camera Input2	Enable camera triggering, from external input IN2, when EXT_TRIG_INTEG_MODE=0	
Trigger Enable: CameraLink CC(4)	Enable camera triggering from Camera Link control signal, when EXT_TRIG_INTEG_MODE=0	

Stop Sequencer at Frame End	Stop the sequencer, when the frame end is reached	Set bit CFG_STOP_AT_FRAME_END in register CFG_REG

Number of profiles

Parameter	Description	Register Operation
Number of 3D Profiles per Frame	Number of profiles per frame to be acquired	Set bits CL_DY in register CL_DY_REG

Camera Link

Parameter	Description	Register Operation
Pulsed FrameValid signal	Produce a pulsed FrameValid signal during the CameraLink data transfer (if required by frame grabber)	
Pulsed LineValid signal	Produce a pulsed LineValid signal during the Camera Link data transfer (if required by frame grabber)	
Frame End Pause	Pause period between the transfer of two frames (in 1000/f ns, where f is the CameraLink-clock frequency in MHz)	
Row End Cause	Pause period between the transfer of two rows (in 1000/f ns, where f is the Cl-clock frequency in MHz)	

RS422 Resolver

Parameter	Description	Register Operation
Count Bidirectional	Count RS422 resolver pulses in both directions	Set bit TRIG_CNT_BIDIR in register TRIG_CNT_H_REG
Invert Count Direction	Reverse the RS422 resolver count direction	Set bit TRIG_CNT_INV in register TRIG_CNT_H_REG
Trigger After Number Of Steps	Define the number of RS422 resolver counts to pass before triggering the camera	Set value in bits TRIG_CNT_L of register TRIG_CNT_L_REG
Status: EN	Indicates that camera triggering is enabled	
Status: OVR	Indicates that the resolver trigger frequency is greater than the actual frame rate (OVERRUN). When OVR occurs then the value of "trigger after number of steps" must be increased.	
Status: UP	Indicates that camera triggering over resolver occurs in one direction	
Clear Overrun Status	Reset the overrun status	

Laser Control (C3 CompactSensors only)

Parameter	Description	Register Operation
Turn Power On	Turn laser on	Set bit LASER_ON in register LASER_CONTROL_REG
Power Level (0-100%)	Adjust the laser power	Set value in bits LASER_POWER in register LASER_CONTROL_REG

Data channels for C3-camera

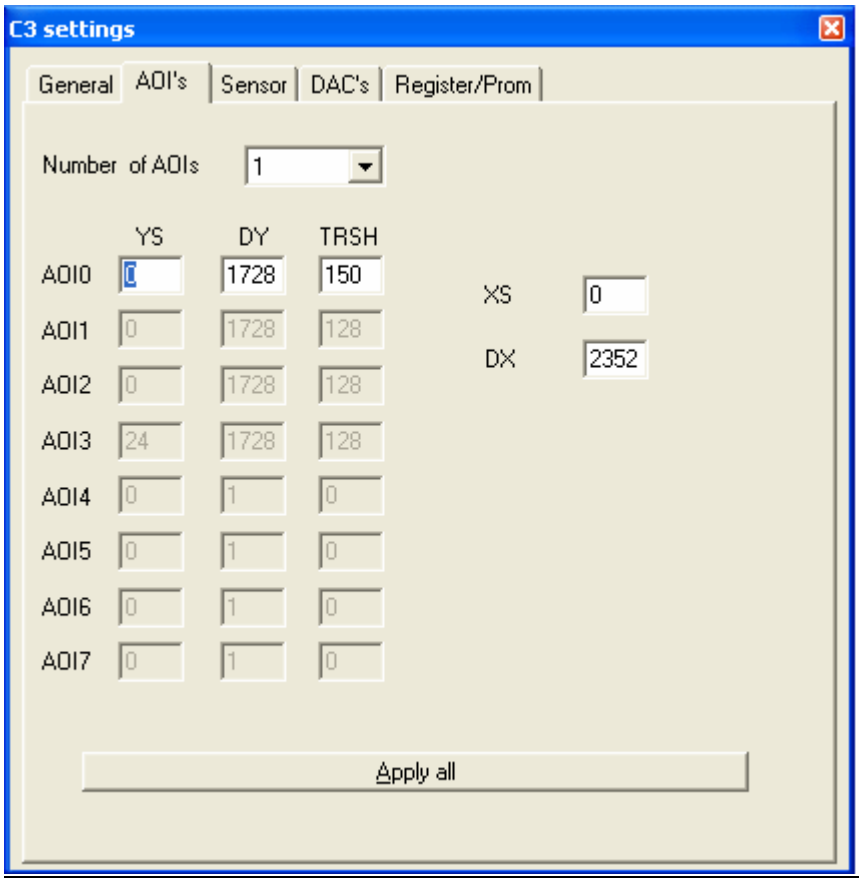
The check boxes *„DC0 (Img, MI, CI)“*, *„DC1 (TL, TW, CW)“*, *„DC2 (TR, SP, MP, CP)“* are used to configure the C3 camera data output channels as follows:

Algorithm	DC0	DC1	DC2
„Image“	Grey scale values	Not used	Not used
„Threshold Position“	Maximum intensity	Left edge of laser line (PosL) or line width (PosR-PosL)	Right edge of laser line (PosR) or line position with 1/2 pixel accuracy (PosL+PosR)
„Maximum Pos.+Intensity“	Maximum intensity	Left edge of laser line (PosL)	Position of maximum intensity (PosM)
„COG“	Sum of intensity values I_s	Left edge of laser line (PosL) or laser line width (PosR-PosL)	Line position with 1/X pixel resolution, where X=1,2,4,8,16,32,64

Algorithm Flags – Output over DC1 in 16 bit mode:

- *LEFT_TRSH_FOUND_FLAG* (Bit 14): indicates that the left edge of laser line was found
- *RIGHT_TRSH_FOUND_FLAG* (Bit 15): indicates that the right edge of laser line was found

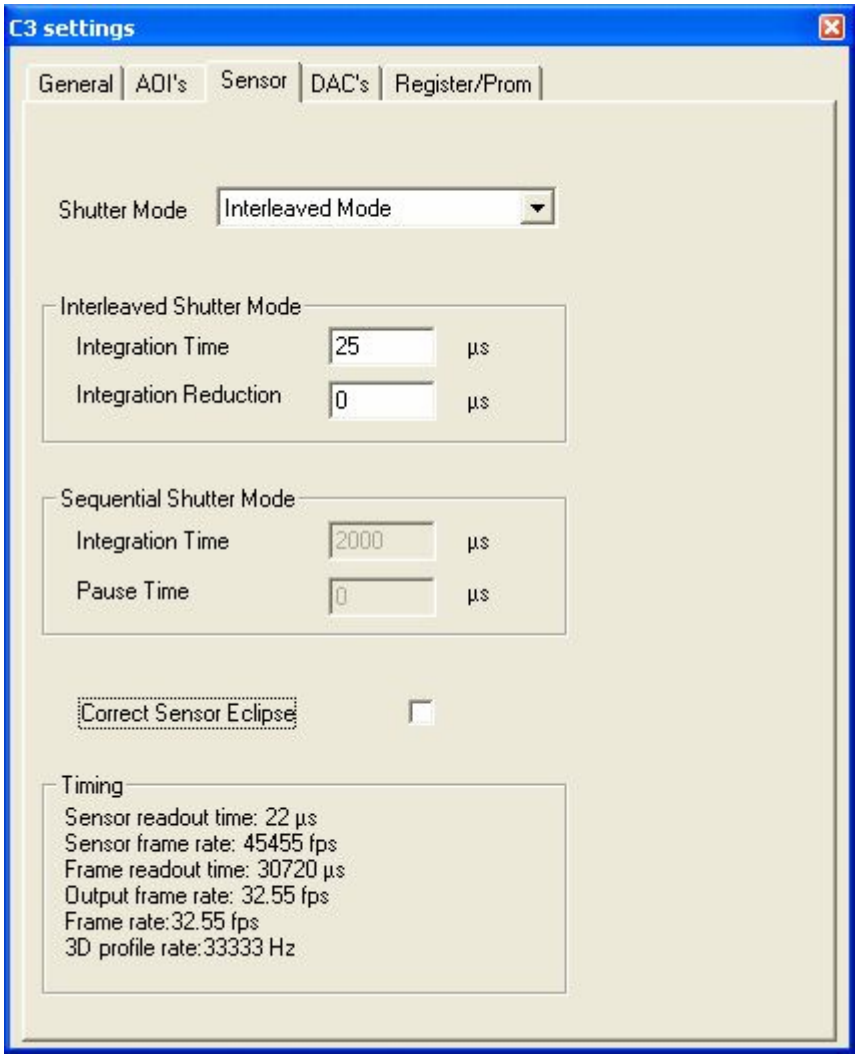
AOI's Tab



Parameter	Description	Register Operation
AOI0…AOI7: YS	Define the starting row of AOI	Set value in bits Y0 of registers AOI0_Y0… AOI7_Y0
AOI0…AOI7: DY	Define the number of rows in AOI	Set value in bits DY of registers AOI0_DY… AOI7_DY
AOI0…AOI7: TRSH	Define the intensity threshold value	Set value in bits TRSH of registers AOI0_TRSH… AOI7_TRSH
Number of AOIs	Select the number of AOIs to be used	Set value in bits NUM_AOIS of register NUM_AOIS_REG
XS	Define the number of pixels per row	Set value in bits CL_DX of register CL_X0_REG
DX	Define the starting column of the output frame with respect to the internal buffer of the camera	Set value in bits CL_DX of register CL_DX_REG

Apply all Apply the modification of AOI parameters

Sensor Tab (C3-1280)



Sensor Timing

Parameter	Description	Register Operation
Integration Time	Define the integration time (in μs)	Set value bits ITIME_L of registers ITIME_L_REG and in bits ITIME_H of registers ITIME_H_REG
Integration Reduction	Enter value (in μs) to reduce the integration time in interleaved mode.	Set value in bits IRTIME_L of registers IRTIME_L_REG and in bits IRTIME_H of registers IRTIME_H_REG
Pause Time	Define the pause period (in μm), when sequential mode is active	Set value in bits PTIME_L of registers PTIME_L_REG and in bits PTIME_H of registers PTIME_H_REG
Correct Sensor Eclipse	Corrects the eclipse effect of CMOS sensor	Set bit SENSOR_CORRECT_ECLIPSE in register SENSOR_REG

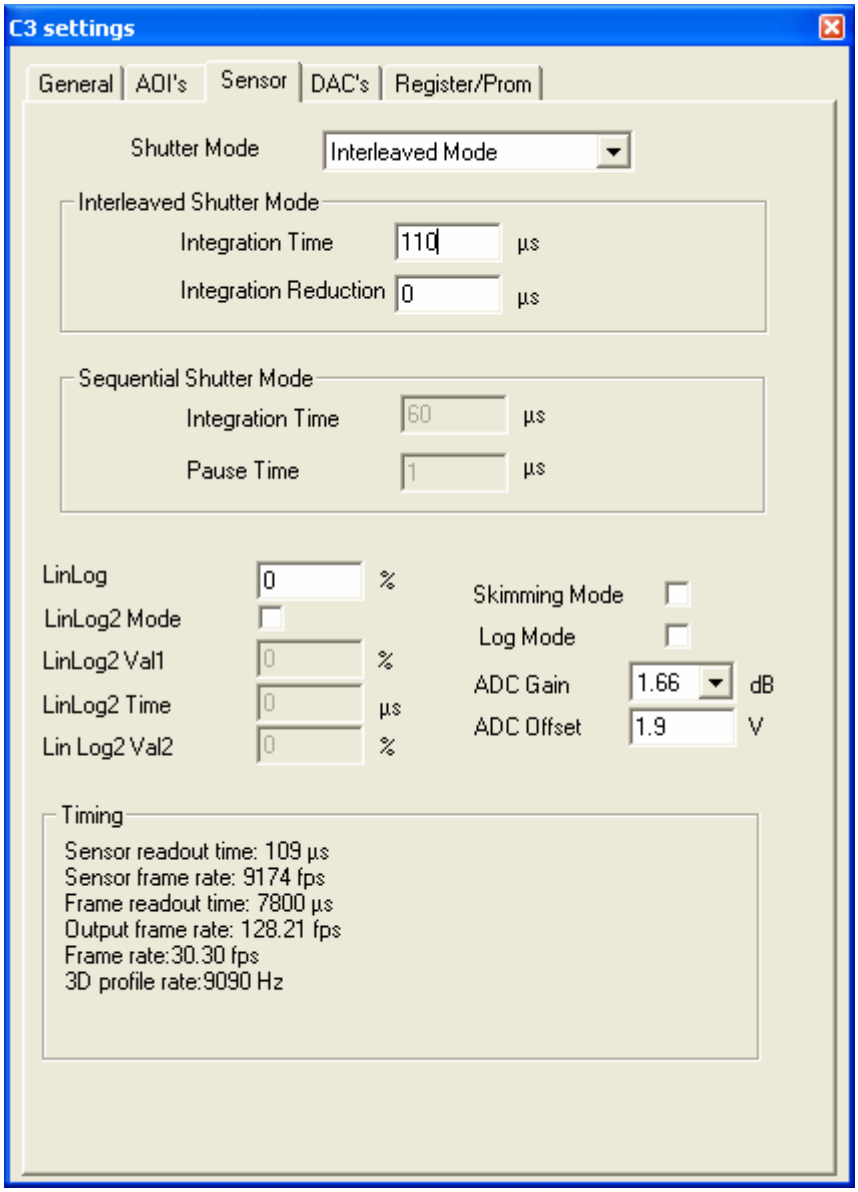
Timing information

The Timing group shows information about the sensors current internal and external timing behaviour.

Shutter Mode

Shutter Mode	Description	Register Operation
Interleaved	Set the shutter mode to interleaved	Set bit SENSOR_INTERLEAVED in register SENSOR_REG
Sequential	Set the shutter mode to sequential	Set bit SENSOR_SEQ in register SENSOR_REG

Sensor Tab (C3-A1024)



Sensor Timing

Parameter	Description	Register Operation
Integration Time	Define the integration time (in µs)	Set value bits ITIME_L of registers ITIME_L_REG and in bits ITIME_H of registers ITIME_H_REG
Integration Reduction	Enter value (in µs) to reduce the integration time in interleaved mode.	Set value in bits IRTIME_L of registers IRTIME_L_REG and in bits IRTIME_H of registers IRTIME_H_REG

Pause Time	Define the pause period (in µm), when sequential mode is active	Set value in bits PTIME_L of registers PTIME_L_REG and in bits PTIME_H of registers PTIME_H_REG

Timing information

The Timing group shows information about the sensors current internal and external timing behaviour.

LinLog Mode

Parameter	Description	Register Operation
LinLog	Enable the LinLog mode	Set bit SENSOR_LINLOG_ON in register SENSOR_REG
LinLog2 Mode	Enable the LinLog2 mode	Set bit SENSOR_LOG_MODE in register SENSOR_REG
LinLog2 Val1	Define the parameter DAC-Value1 of the LinLog2 algorithm	Set value in bits LINLOG_VAL0 of register LINLOG_VAL0_REG
LinLog2 Time	Define the time parameter of the LinLog2 mode (in µs)	Set value in bits LINLOG_TIME_L of register LINLOG_TIME_L_REG and in bits LINLOG_TIME_H of register LINLOG_TIME_H_REG
LinLog2 Val2	Define the parameter DAC-Value2 used by the LinLog2 mode	Set value in bits LINLOG_VAL1 of register LINLOG_VAL1_REG
Skimming Mode	Enable the skimming mode	Set bit SENSOR_SKIMMING_ON in register SENSOR_REG
Log Mode	Set the sensor log mode	Set bit SENSOR_LOG_MODE in register SENSOR_REG

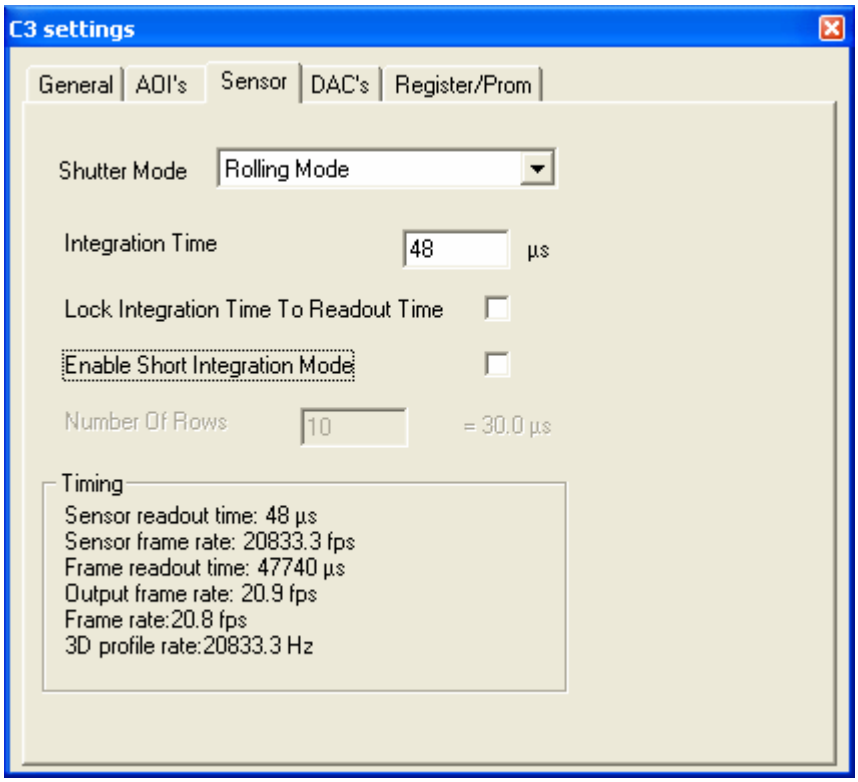
ADC-Settings

Parameter	Description	Register Operation
ADC Gain	Set the ADC gain	Set value in bits ADC_A_GAIN of register ADC0_REG
ADC Offset	Set the ADC offset	Set value in bits DAC_VAL, set DAC_ADDR=2 in register DAC_REG

Shutter Mode

Shutter Mode	Description	Register Operation
Interleaved	Set the shutter mode to interleaved	Set bit SENSOR_INTERLEAVED in register SENSOR_REG
Sequential	Set the shutter mode to sequential	Set bit SENSOR_SEQ in register SENSOR_REG

Sensor Tab (C3-2350)



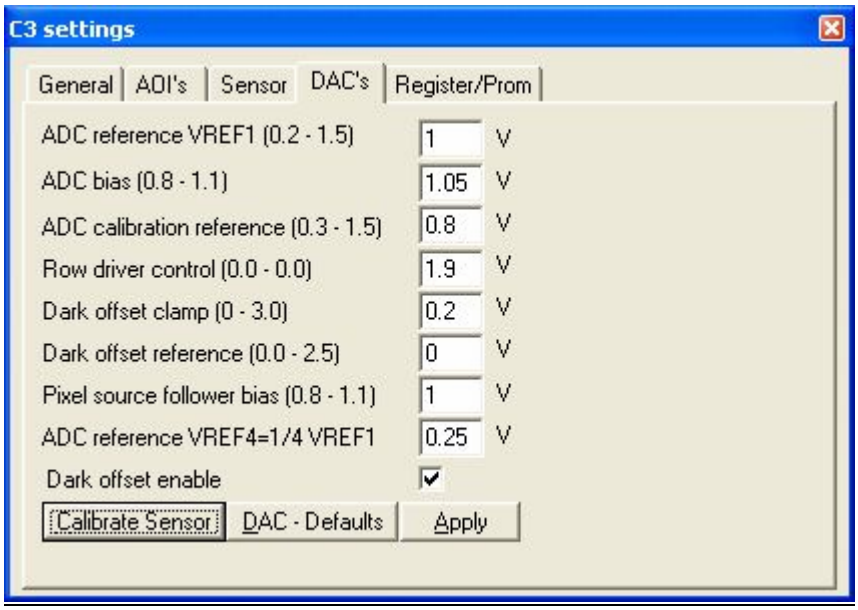
Sensor Timing

Parameter	Description	Register Operation
Integration Time	Define the integration time (in µs)	Set value bits ITIME_L of registers ITIME_L_REG and in bits ITIME_H of registers ITIME_H_REG
Enable Short Integration Mode	Enables the "Short Integration Mode". This mode is used, when the integration time is needed to be smaller than the sensor readout time (3D mode) of CL-frame readout time (image mode)	Set bit SENSOR_SHORT_INTEG_MODE in register SENSOR_REG
Number Of Rows	Enter number of rows in order to adjust the "Short Integration Mode". The resulting integration time is shown for convenience.	Set value in bits IRTIME_L of registers IRTIME_L_REG and in bits IRTIME_H of registers IRTIME_H_REG

Timing information

The Timing group shows information about the sensors current internal and external timing behaviour.

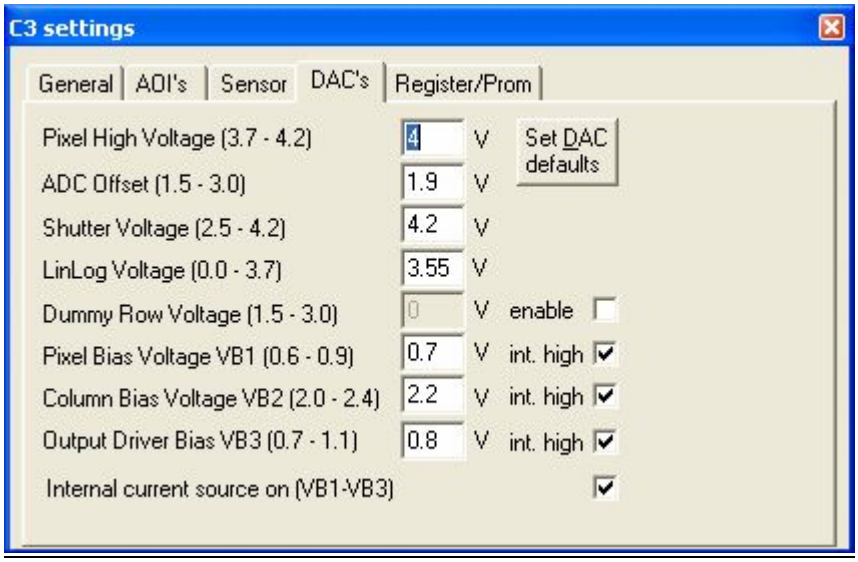
DAC's Tab (C3-1280)



Parameter	Description	Register Operation
ADC reference VREF1 (0.2-1.5)	Set the ADC VREF1 reference voltage	Set value in bits DAC_VAL, set DAC_ADDR=1 in register DAC_REG
ADC bias (0.8-1.1)	Set the ADC reference bias voltage	Set value in bits DAC_VAL, set DAC_ADDR=2 in register DAC_REG
ADC calibration reference (0.3-1.5)	Set the ADC calibration reference voltage	Set value in bits DAC_VAL, set DAC_ADDR=3 in register DAC_REG
Row driver control (0.0-0.0)	Set the row driver control voltage	Set value in bits DAC_VAL, set DAC_ADDR=4 in register DAC_REG
Dark offset clamp (0 – 3.0)	Set the dark offset clamp voltage	Set value in bits DAC_VAL, set DAC_ADDR=5 in register DAC_REG
Dark offset reference (0.0-2.5)	Set the dark offset reference voltage	Set value in bits DAC_VAL, set DAC_ADDR=6 in register DAC_REG
Pixel source follower bias (0.8-1.1)	Set the pixel source follower bias voltage	Set value in bits DAC_VAL, set DAC_ADDR=7 in register DAC_REG
ADC reference VREF4=1/4 VREF1	Set the ADC VREF4 reference voltage	Set value in bits DAC_VAL, set DAC_ADDR=8 in register DAC_REG
Dark offset enable	Enable dark offset	Set bit DARK_OFF_EN in register SENSOR_REG

Calibrate Sensor	Perform sensor calibration
DAC-Defaults	Set all DAC-values to the factory default values.
Apply	Set all DAC-values at once.

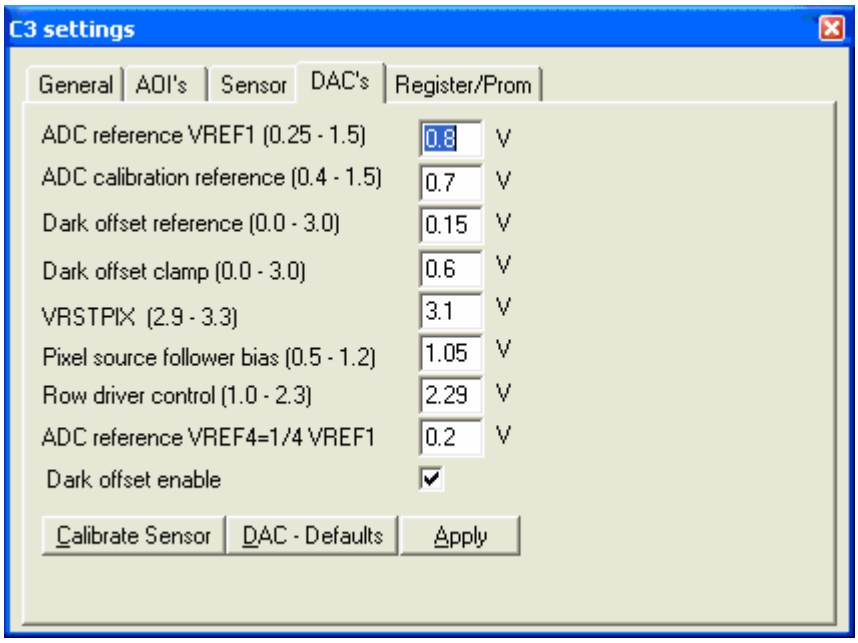
DAC's Tab (C3-A1024)



Parameter	Description	Register Operation
Pixel High Voltage (3.7 -4.2)	Set pixel high voltage	Set value in bits DAC_VAL, set DAC_ADDR=1 in register DAC_REG
ADC offset (1.5 - 3.0))	Set ADC offset voltage	Set value in bits DAC_VAL, set DAC_ADDR=2 in register DAC_REG
Shutter Voltage (2.5 – 4.2)	Set shutter voltage	Set value in bits DAC_VAL, set DAC_ADDR=3 in register DAC_REG
LinLog Voltage (0.0 – 3.7)	Set LinLog Voltage	Set value in bits DAC_VAL, set DAC_ADDR=4 in register DAC_REG
Dummy Row Voltage (1.5 – 3.0)	Set dummy row voltage	Set value in bits DAC_VAL, set DAC_ADDR=5 in register DAC_REG
Pixel Bias Voltage VB1 (0.6 – 0.9)	Set pixel bias voltage VB1	Set value in bits DAC_VAL, set DAC_ADDR=6 in register DAC_REG
Column Bias Voltage VB2 (2.0 – 2.4)	Set column bias voltage	Set value in bits DAC_VAL, set DAC_ADDR=7 in register DAC_REG
Output Driver Bias VB3 (0.7 – 1.1)	Set output driver bias	Set value in bits DAC_VAL, set DAC_ADDR=8 in register DAC_REG
Dummy Row Voltage Enable	Enable dummy row voltage	Set bit SENSOR_DUMMY_ROW_EN in register SENSOR_REG
Pixel Bias Voltage int. high	Set pixel bias voltage int. high	Set bit HIGH_VB1 in register SENSOR_REG
Column Bias Voltage int. high	Set column bias voltage int. high	Set bit HIGH_VB2 in register SENSOR_REG
Output Driver Bias int. high	Set output driver bias voltage int. high	Set bit HIGH_VB3 in register SENSOR_REG
Internal current source on (VB1-VB3)	Set internal current source	Set bit CURR_ON in register SENSOR_REG

Set DAC-Defaults Set all DAC-values to the factory default values.

DAC's Tab (C3-2350)



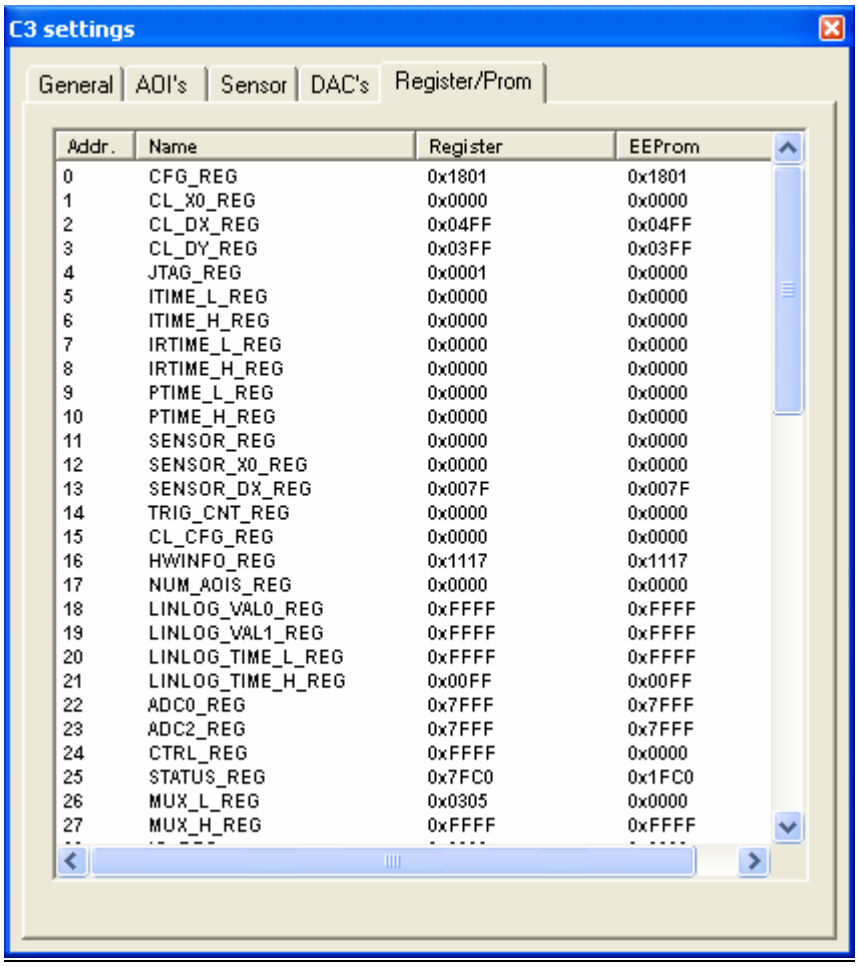
Parameter	Description	Register Operation
ADC reference VREF1 (0.25-1.5)	Set the ADC VREF1 reference voltage	Set value in bits DAC_VAL, set DAC_ADDR=1 in register DAC_REG
ADC calibration reference (0.4-1.5)	Set the ADC calibration reference voltage	Set value in bits DAC_VAL, set DAC_ADDR=2 in register DAC_REG
Dark offset reference (0.0-3.0)	Set the dark offset reference voltage	Set value in bits DAC_VAL, set DAC_ADDR=3 in register DAC_REG
Dark offset clamp (0.0 – 3.0)	Set the dark offset clamp voltage	Set value in bits DAC_VAL, set DAC_ADDR=4 in register DAC_REG
VRSTPIX (2.9-3.3)	Set the VRSTPIX voltage	Set value in bits DAC_VAL, set DAC_ADDR=5 in register DAC_REG
Pixel source follower bias (0.5-1.2)	Set the pixel source follower bias voltage	Set value in bits DAC_VAL, set DAC_ADDR=6 in register DAC_REG
Row driver control (1.0-2.3)	Set the row driver control voltage	Set value in bits DAC_VAL, set DAC_ADDR=7 in register DAC_REG
ADC reference VREF4=1/4 VREF1	Set the ADC VREF4 reference voltage	Set value in bits DAC_VAL, set DAC_ADDR=8 in register DAC_REG
Dark offset enable	Enable dark offset	Set bit DARK_OFF_EN in register SENSOR_REG

Calibrate Sensor Perform sensor calibration

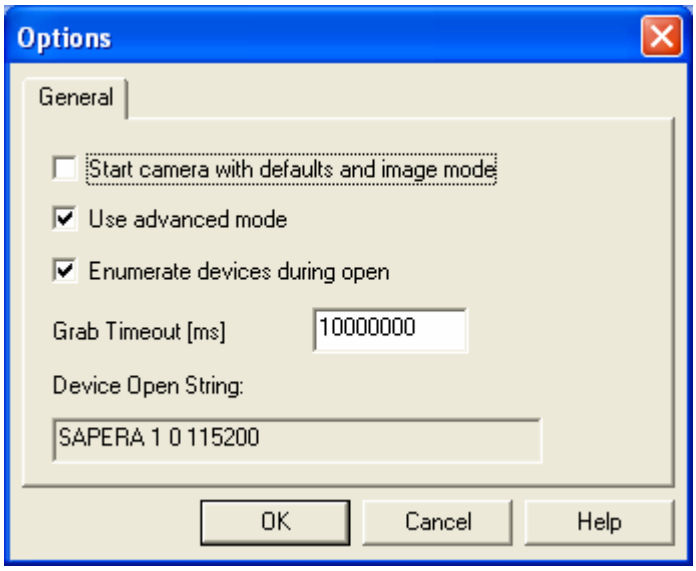
DAC-Defaults Set all DAC-values to the factory default values.

Apply Set all DAC-values at once.

Register/Prom Tab

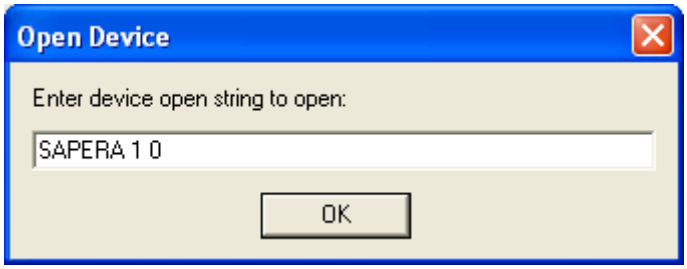


The Application Options dialogue



The Options dialogue box appears by selecting the menu Options or by clicking the  icon on the C3 Explorer toolbar.

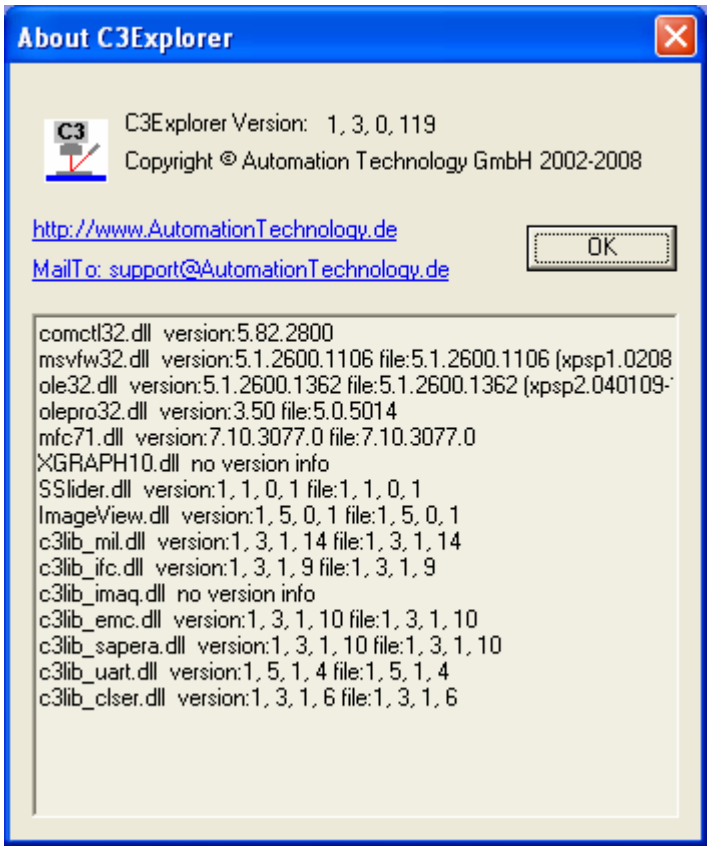
Start camera with defaults and image mode	The C3 Explorer sets the camera in image mode and loads the default settings during start-up.
Use advanced mode	Allow the adjustment of further camera parameter. The Sensor and DAC's tab appears on the camera settings dialogue box.
Enumerate devices during open	If this option is enabled then the C3 Explorer performs a device enumeration, when opening a connection to the camera. The enumeration can be time consuming depending on the number of cameras connected to the host system. By disabling this option, the enumeration can be bypassed. In that case the user is prompted to enter the device open string in order to open the connection to the camera:



Alternatively, the camera connection can be opened without

	performing enumeration by starting the C3 Explorer using the following command line argument: *"c3libname:DeviceOpenString"* where - *c3libname* is the name of C3Lib DLL to load (see interface selection dialogue box for details) *-DeviceOpenString* is the open string of camera Example: C3Explorer.exe "c3lib_sapera.dll:SAPERA 1 0" This example will start the C3 Explorer and open the connection to the camera, which is connected to the first port of the first DALSA frame grabber installed at the host system.
Grab Timeout [ms]	Set timeout for image triggering
Device Open String	Device Open String of the C3 camera

The About C3Explorer dialogue



The About C3 Explorer dialogue box appears by selecting the menu item About C3 Explorer from the menu Help. It shows release information about C3Explorer and function library files (DLL).

The C3 image display

The C3 image display is used to show the current 2D or 3D image acquired from the C3 camera. In image mode the image display shows a grey scale image.

Example of image display in image mode

In 3D mode the image display shows the 3D profile data acquired from the C3 camera. The total number of profiles shown in one frame can be set at the General tab of the Camera Settings dialogue box.

Example of a 3D image display

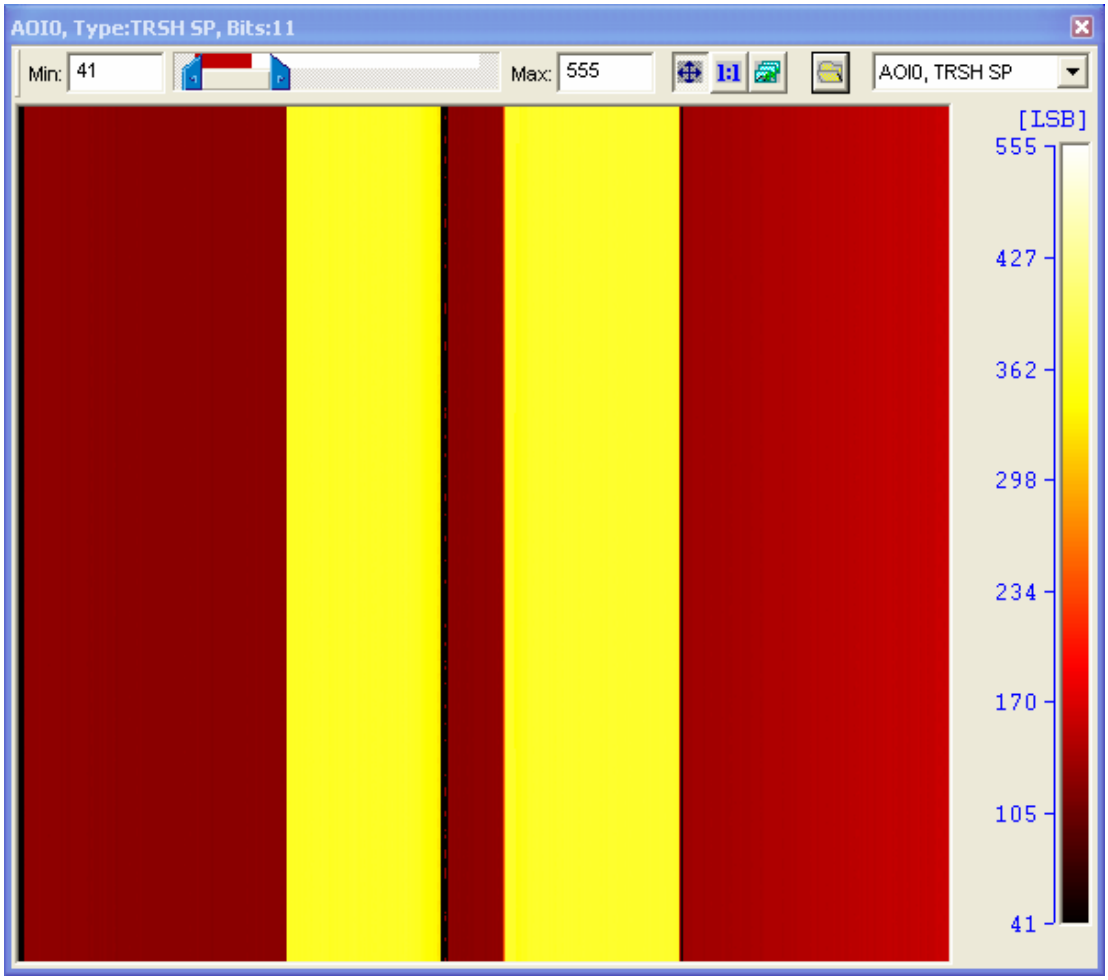


Image Display toolbar

Drag to adjust the minimum height value of scaling control. Double-click to fix limit.

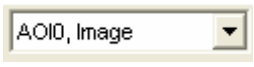
Drag to adjust the maximum height value of scaling control. Double-click to fix limit.

Scale to fit (do not keep aspect ratio)

Scale 1:1

Scale to fit (keep aspect ratio)

Load colour palette for pseudo color visualisation of image data.



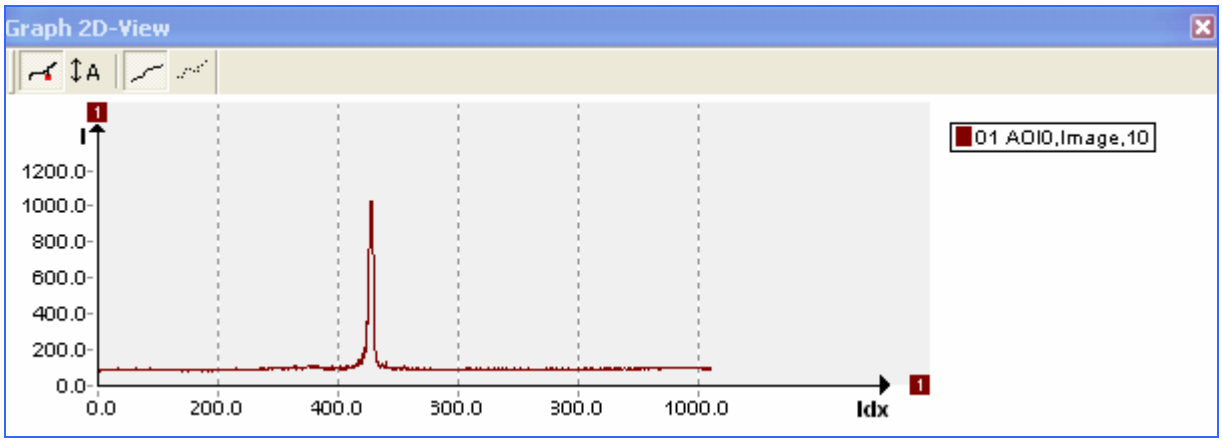
The current AOI name and Data Channel (DC) to be visualised can be selected form the combo box of the image display.

On the title bar appears the current AOI name, Data Channel and image depth

The 2D-View Graph

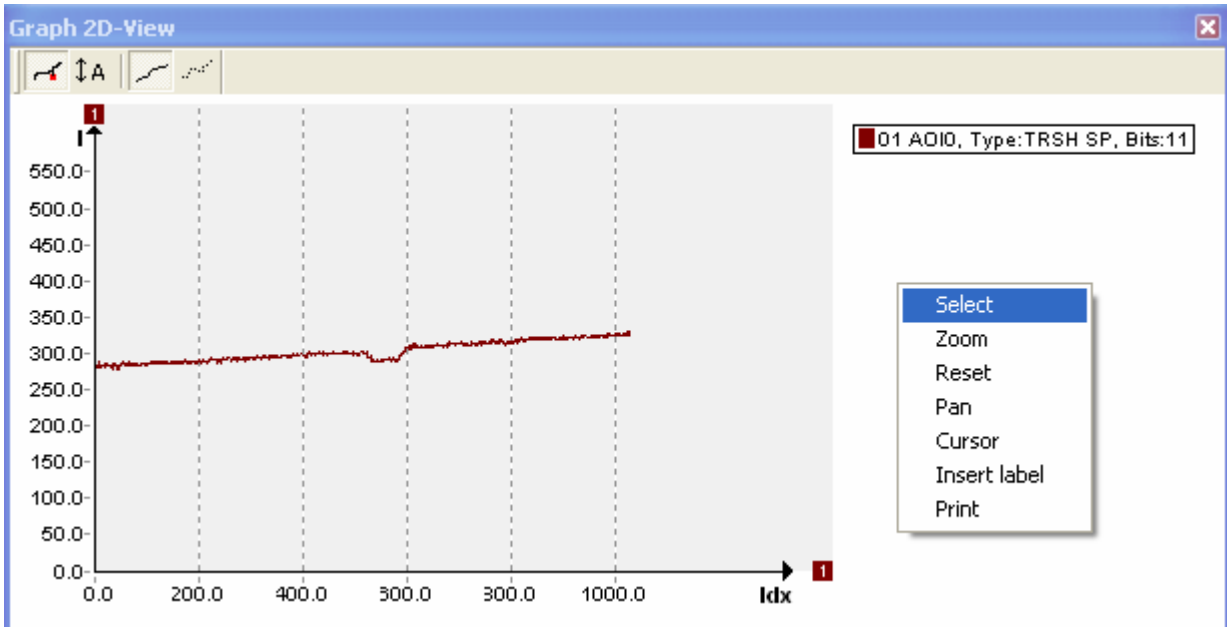
The 2D-View Graph is a very helpful graphical tool, which displays profile data. In image mode the 2D-View Graph shows the intensity profile along the column located in the middle of the sensor.

Example of intensity profile plot



In 3D mode the 2D-View Graph shows the height data acquired from the C3 camera.

Example of 3D height profile plot



2D-GraphView Pop-Up Menu

A pop-up context menu appears by right clicking on the 2D-View Graph

Select	Select a region of the graph
Zoom	Perform zoom
Reset	Reset the graph display
Pan	Pans the entire graph
Cursor	A cursor appears showing information about the displayed data
Insert Label	Insert a label

2D-GraphView toolbar

	Suppress zero pixel.
	Auto scale graph
	Connect data points with line segments
	Plot data as points

Interface Information

Camera Link

Specific information about Matrox MeteorII-CL

- C3-Lib supports both multiplexed Camera Link ports. The frame grabber does not implement a real dual port interface for simultaneous grabbing from two cameras!
- C3-Lib supports serial communication over MIL - functions with 9600 or 115200 Baud and acquisition functionality for this frame grabber.
- The frame grabber supports clserial interface according to Camera Link Spec. 1.0, without configurable baud rate (only 9600 Baud can be used via the clser –DLL). In order to use the Matrox clser-DLL "clsermtx.dll" it is necessary to install Matrox GNL 3.24 Build 4 or higher. In releases prior to 3.24 the clser-interface did not work correctly.
- Supported image processing software, e.g.: MIL , HALCON.
- The camera configuration files are typically located in "MIL installation directory"\gnl\dcf or in the application directory. For C3Lib – based applications the location of the camera configuration files can be specified by setting the environment variable "C3_DCF_PATH". This environment variable will be set during installation of C3Explorer / C3Lib.
- Required frame grabber support software: Matrox frame grabber driver and Matrox MIL or MIL-Lite 7.5 runtime environment.

Specific information about Coreco PC-CamLink, PC2-CamLink

- The frame grabber supports mapping of the Camera Link UART to a standard PC-COM port. A baud rate of 9600 or 115200 baud can be used for connecting the camera.
- The frame grabber supports clserial interface according to Camera Link Spec. 1.0, without configurable baud rate (only 9600 Baud can be used via the clser –DLL "clsercii.dll").
- C3-Lib supports serial communication over IFC functions with 9600 or 115200 baud and acquisition functionality for these frame grabbers.
- Supported image processing software, e.g.: IFC, ITEX, CVB.
- **PC2-CamLink** : since the PC2-CamLink is FIFO based without on-board image memory, data loss will happen in 2x12 mode. See chapter PCI-Bandwidth limitation.
- The camera configuration files are typically located in "IFC installation directory"\config or in the application directory. Furthermore, the location of the configuration files can be specified by setting the environment variable "IFCCNF".

- Required frame grabber support software: Coreco frame grabber driver and IFC 5.7 runtime environment.

Specific information about Dalsa X64CL-Ipro/Lite/Express and X64-Xcelera-CL

- These frame grabbers (except X64CL-Iprolite) do implement a real dual port Camera Link interface for simultaneous grabbing from two cameras.
- The frame grabber supports mapping of the Camera Link UART to a standard PC-COM port. A baud rate of 9600 or 115200 baud can be used for connecting the camera.
- The frame grabber supports clserial interface according to Camera Link Spec. 1.1
- C3-Lib supports serial communication and acquisition functionality for these frame grabbers.
- Supported image processing software, e.g.: CVB
- PCI 64-bit/66MHz
- on-board memory: 16/32MB (single/dual port)

Specific information about Euresys GrabLink Value, GrabLink Expert2

- The frame grabber does implement a real dual port Camera Link interface for simultaneous grabbing from two cameras.
- The frame grabber supports mapping of the Camera Link UART to a standard PC-COM port. A baud rate of 9600 or 115200 baud can be used for connecting the camera.
- The frame grabber supports clserial interface according to Camera Link Spec. 1.1 with 9600. Known bugs in the clserial implementation: shows version 1.0, runs only with 9600 baud, use clFlushInputBuffer instead of clFlashPort.
- C3-Lib supports serial communication and acquisition functionality for these frame grabbers.
- Supported image processing software, e.g.: HALCON.
- PCI 64-bit/66MHz
- on-board memory: 8/16MB
- requires C3-Register FrameEndPause set to 25
- Required frame grabber support software: Euresys frame grabber driver and Multicam 4.3 run-time environment. Choose the installation option RunTime in the Multicam Installation procedure for installing only run-time components.

Specific information about NI-IMAQ (PCI/PXI-1426/1428)

- The frame grabber supports mapping of the Camera Link UART to a standard PC-COM port with 9600 baud.
- The frame grabber supports clserial interface according to Camera Link Spec. 1.1 with 9600 baud (the on-board UART is limited to a maximum baud rate of 57600 baud).
- C3-Lib supports serial communication over NI-IMAQ functions with 9600 baud and acquisition functionality for this frame grabber.
- There is currently no support for reconfiguring the frame grabber configuration without applying a specific configuration file. Therefore the NI-IMAQ based C3-Lib

implementation always shows three different camera configurations when opening the camera connection.

- Supported image processing software, e.g.: NI-IMAQ, LabView.
- on-board memory: 16MB
- Camera Link clock: 20-50MHz

Specific information about CLSERIAL interface

- C3Lib supports all clser interface DLLs according to Camera Link Spec. 1.0 and 1.1.
- Note that clser DLLs according to Camera Link Spec. 1.0 only works with 9600 Baud. With Camera Link Spec. 1.1 clser-DLLs the baud rate can be configured. This is automatically handled in the C3Lib. For 9600 Baud mode the C3-camera configuration DIP-switch inside the camera needs to be set to 9600 mode enabled.
- The C3Lib relies on the clallserial implementation (as recommended in Camera Link Spec. 1.1), which handles the enumeration of all installed Camera Link – clserial channels.
- The clallserial-DLL uses the following registry key for locating the clserial – DLLs of different Camera Link vendors.
  [HKEY_LOCAL_MACHINE\SOFTWARE\cameralink]
  "CLSERIALPATH"=" C:\Programme\Automation Technology GmbH\C3_13\FrameGrabberSupport\ cameralink_clser_dlls "
  This key will be set during installation of C3Explorer / C3Lib.

PCI-Bandwidth Limitation with Camera Link

When the 2 x 12-bit mode running at 40MHz Camera Link output rate is activated the resulting camera bandwidth is greater than the available bandwidth of the 32Bit PCI-bus. This effect leads to a maximum frame rate of 50 fps when live image mode is used. In case that a higher frame rate (60 fps) is required a PCI-64-bit frame grabber should be used. When grabbing a single image into frame grabber on-board memory this limitation does not arise as long as the time between consecutive images is sufficient for the transfer of the image from on-board memory to host memory.

Service Information

Document Revision

Rev. Nr.	Date	Modification
1.0	25.08.2003	first release
1.1	08.12.2004	added specific support information for different Camera Link frame grabbers
1.2	23.03.2007	Update GUI description
1.3	13.02.2008	Added C3-2350
1.4	05.06.2008	Added new registers for 3D validation, digital output of OVR flag, Correct Sensor Eclipse
1.5	26.11.2008	Added new features of firmware 4.8
1.6	26.05.2009	Added new features concerning enumeration bypass

Product Information and Updates

Updates

www.AutomationTechnology.de

Service and Support

service@AutomationTechnology.de

In order to process your support inquiries immediately, we always need the serial number of the camera, a dump of configuration EPROM's, a snapshot and a precise problem description.

Product Inquiries and Price Quotations

info@AutomationTechnology.de

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